The Early Devonian Trilobite *Craspedarges* from the Winduck Group, Western New South Wales.

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Specimens of the lichid trilobite *Craspedarges wilcanniae* Gürich from the Early Devonian Winduck Group in 'The Meadows' area, near Cobar, in western New South Wales, enable a revised description and a neotype to be designated to replace types destroyed during World War II.

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INTRODUCTION

In 'The Meadows' area (Figure 1), south–west of Cobar in western New South Wales, the Early Devonian (Lochkovian) lichid trilobite *Craspedarges wilcanniae* occurs in the Winduck Group (Glen 1987), a unit within the widely distributed Cobar Supergroup. The stratigraphy and brachiopod faunas of this area have been described elsewhere (Sherwin 1992, 1995) and on a broader scale the structural setting has been described by Glen (1990). Geological mapping in this particular area was handicapped by poor outcrop but the favoured interpretation is that the Winduck and Amphitheatre Groups have an interfingering relationship (Figure 2), with the Winduck Group sedimentation continuing for a longer period. Trilobites have not been reported previously from this area, the nearest occurrences in the Cobar Supergroup being in the vicinity of Cobar (Baker et al. 1975, Fletcher 1975), 60 kilometres north–east of "The Meadows". Ebach and Edgecombe (1999) described a new species of the proetid *Cordania* from the vicinity of "The Bluff", south of Cobar, in the Biddabirra Formation (Amphitheatre Group) which underlies the Winduck Group. Fletcher (1975) also described several other species of trilobites from the vicinity of Cobar and several localities north–east of Nymagee where Webby (1972) had noted an *Encrinurus* occurrence. From that same area, Landrum and Sherwin (1976) described a new proetid, *Warburgella (Anambon) jelli*, regarded by Yolkin (1983) as a junior synonym of the Eurasian species *Warburgella tcherkesovae* Maximova and *Warburgella waigatschensis* (Tschernyschev and Yakovlev, 1898). Strusz (1980) reviewed the species of *Encrinurus* described by Fletcher and regarded the specific attributions as doubtful because of the poor preservation. The stratigraphy of the Nymagee localities has been described by Felton (1981). The lichid trilobite *Craspedarges wilcanniae* Gürich, found at several localities within the Winduck Group, was described from erratics, believed derived from the Cobar Supergroup, in Cretaceous sediments at White Cliffs (Gürich 1901) about 230 kilometres north-west of "The Meadows" (Figure 1).

Several genera of trilobites are represented in "The Meadows" district but only the lichid species is described here. The encrinurids occur in pinkish mudstones of the Late Silurian to Early Devonian Amphitheatre Group and are generally complete, although fine details are not well preserved. In the Winduck Group probable *Gravicalymene* is associated with *Craspedarges* but is otherwise too poorly preserved to warrant description and proetids are represented by a nondescript pygidium.

AGE OF THE FAUNA

The brachiopods associated with *Craspedarges wilcanniae* indicate an Early Devonian (Lochkovian) age (Sherwin 1995). The only other recorded species of *Craspedarges*, *C. superbus*, was described from

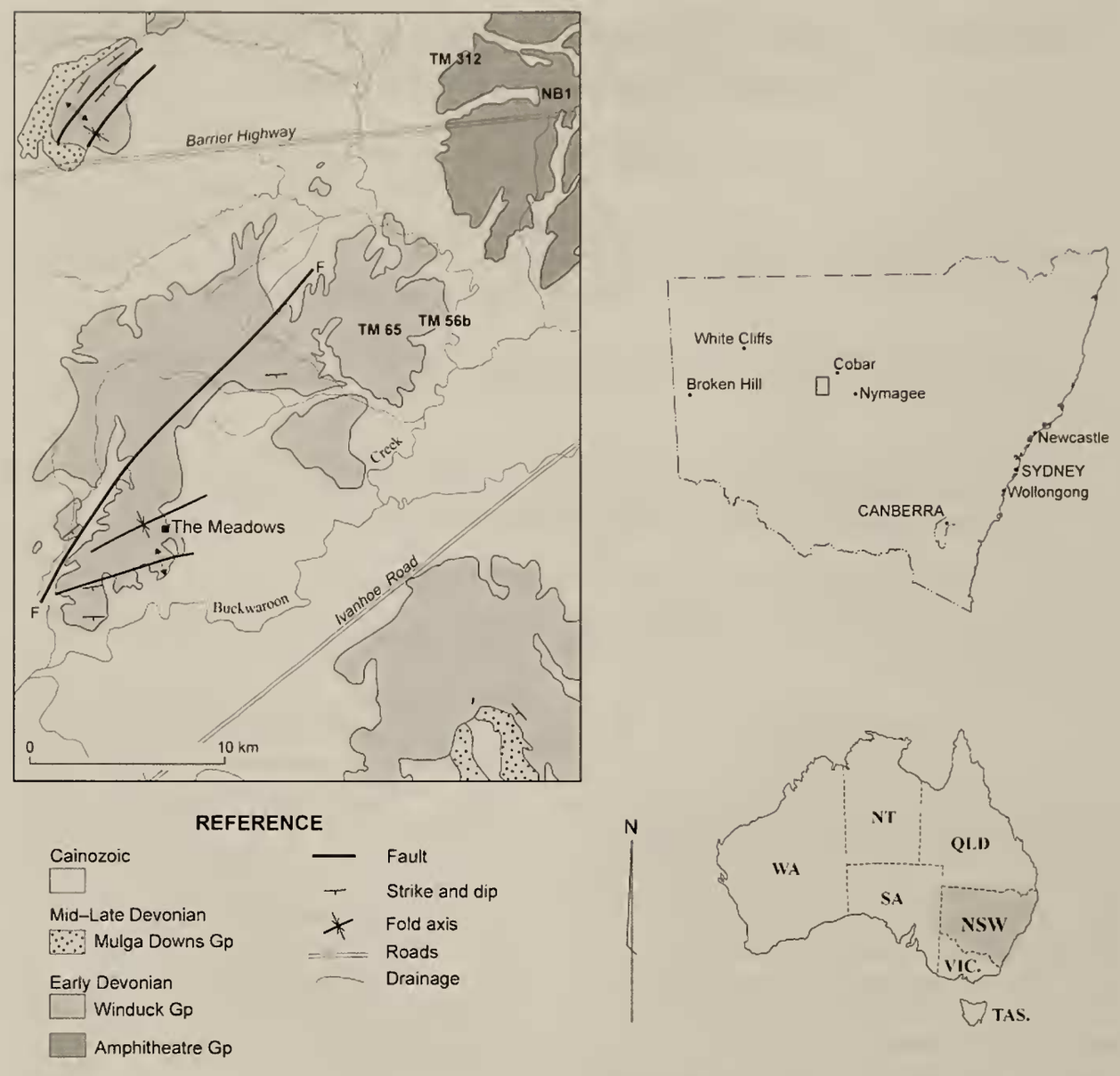

Figure 1. Locality diagram showing places mentioned in text, fossil localities and geological sketch map, modified from Rose (1965).

the 'Gedinnian to Emsian or early Eifelian' Fukuji Series in Japan by Kobayashi and Hamada (1977a, b), although the generic identification was queried by Thomas and Holloway (1988). Lichid trilobites have been described from Early Devonian (Pragian–Emsian) limestones in New South Wales (Edgell 1955; Chatterton 1971; Chatterton et al. 1979; Edgecombe and Wright 2004) and quartzose clastics in Victoria (Gill 1939; Holloway and Neil 1982) but all belong to the genus *Acanthopyge* except for one doubtful reference to *Terranovia* from New South Wales (Chatterton and Wright 1986).

SYSTEMATIC PALAEONTOLOGY

Morphological terms, unless otherwise specified, are as defined in the Treatise on Invertebrate Paleontology (Moore, ed. 1959), supplemented with lichid morphology of Thomas and Holloway (1988) except that we do not regard the occipital ring as part of the glabella.. All specimens are stored in the collections of the Geological Survey of New South Wales at Londonderry in western Sydney. External moulds were studied using latex casts and all specimens, whether casts or originals, were whitened with MgO for photography. Actual specimens were blackened with water colour before application of MgO.

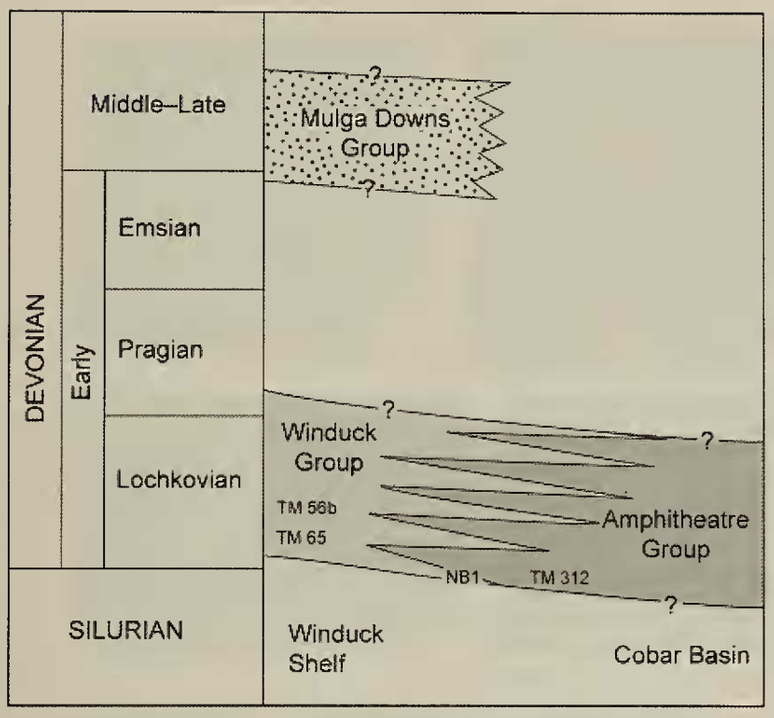

Figure 2. Stratigraphic relationships in "The Meadows" district, modified from Glen (1987), showing approximate stratigraphic position of trilobite localities. *Craspedarges wilcanniae* occurs at localities TM56b and TM65. Encrinurus occurs at localities NB1 and TM312. In this area it has not been possible to recognise formations within the Amphitheatre and Winduck Groups.

Family LICHIDAE Hawle and Corda, 1847
Subfamily TROCHURINAE Phleger, 1936
Craspedarges Gürich, 1901

Type species

Craspedarges wilcanniae Gürich, 1901

Diagnosis (revised)

Trochurine with very globose cranidium; anterior border wide and gently convex in section (sag.), becoming flatter near suture; longitudinal furrows shallow posteriorly, much deeper anteriorly including in front of S1 and subparallel for most of length from posterior edge of cranidium, diverging anteriorly to join border furrow; S1 deep behind bullar lobes, weak between longitudinal furrows; portion of L1 between longitudinal furrows much lower than occipital ring and median lobe but approximately the same width (trans.) as the occipital ring. Pygidium approximately as wide as long with narrow well developed raised border; rachis approximately one third the maximum width of the pygidium; first pair of pleurae backwardly flexed, second less so but more inclined to rachis, third subparallel to rachis; abaxial ends of pleurae continued beyond border as tapered spines with circular cross sections; rachis parallel sided for approximately one third length of pygidium, remainder tapered and continued beyond border as terminal spine flanked by a pair of border spines.

Remarks

The types of this genus are believed to have been destroyed with the remainder of Gürich's collection, housed originally in Breslau (now Wrocław), when Hamburg was bombed during World War II. Although a significant part of the collection survived the war, there is no trace of the types of *Craspedarges* or even the associated brachiopods (J. Dzik, pers. comm.).The search described by Thomas and Holloway (1988) was repeated as well as extended to the Geological Survey of New South Wales collections without any success. This redescription is based upon material found *in situ* in sandstones of the Winduck Group. Gürich's types came from erratic boulders, as noted above, but the exact source, or sources, of the erratics is unknown, there being very little pre–Quaternary outcrop between White Cliffs and 'The Meadows', although the erratics are comparable in lithology and faunal content (Dun 1898) with the Winduck Group.

Because of doubts about the source of the erratics it is necessary to establish that the lichids from the Winduck Group are truly *Craspedarges*. Gürich's material consisted of an internal mould of an incomplete cranidium and three fragmentary moulds of ventral surfaces of the pygidium. The cranidium, except for some flattening indicated by a line drawing of the profile, matches the Winduck Group material. Matching the pygidia is difficult because the one pygidium known from the Winduck Group has more or less uniformly slender marginal spines preserved whereas two (Gürich, pl. 18, figures 6 and 8) of Gürich's specimens have comparatively short and wide spines. These two particular specimens are very fragmentary and it is not at all certain that they belong to the same species, ie., *C. wilcanniae*. The remaining fragment illustrated by Gürich (pl. 18, figure 7) is of the posterior margin and is reconcilable to a greater extent with the Winduck Group specimen. Gürich's specimens are illustrated by drawings only so that there is a possibility that the figures are not

necessarily an accurate representation of the original specimens, especially his diagrammatic sketch of a flattened and incomplete cranidium (pl. 20, figure 20). The illustration in the trilobite Treatise (Moore 1959, figure 396–6a) is a line drawing that does not correspond with either of Gürich's sketches but seems to be based upon a composite of the two. The cephalic profile in the Treatise (figure 396–6b) is clearly copied from Gürich (figure 1a) but the anterior border has been changed from planar to slightly concave and the figure generally flattened. In this paper (figure 3, A and B) a slightly flattened cranidium has been placed alongside the comparatively undeformed neotype to show the distorted anterior border resembles the Treatise illustration. The shading in Gürich's illustration (pl. 18, figure 1) suggests that some convexity remains in the left side of the anterior border.

Craspedarges is closely related to *Richterarges*, as noted by Thomas and Holloway (1988), the major differences being the more prominent anterior border and much deeper anterior part of the longitudinal furrows. A slight midlength expansion in the median lobe of *Richterarges* has no analogue in the corresponding part of *Craspedarges* where the sides of the median lobe are straight. The pygidium of *Richterarges* has only two distinct pleurae compared with three in *Craspedarges*. Thomas and Holloway also postulated that *Craspedarges* was derived from *Richterarges* in about Late Silurian to Early Devonian time, which accords with the age of the Winduck Group. However. the pygidial segmentation in *Craspedarges* is less effaced than *Richterarges*, suggesting that it departed earlier from the ancestral hemiargid stock.

Pollit et al. (2005) carried out a cladistic study and Bayesian analysis of the Family Lichidae but excluded *Craspedarges* from consideration because of its poorly known morphology; they did recognise that it is closely related to the group represented by *Acanthopyge*, *Akantharges*, *Ceratarges* and *Borealarges* and in other respects to the group containing *Richterarges* and *Terranovia*.

Craspedarges wilcanniae Gürich, 1901 (Figure 3)

1901 *Craspedarges wilcanniae* Gürich, p. 532–538, pl. 18, figures 1, 6–8; pl. 20, figure 20.

Neotype

MMF 31377(5) a cranidium lacking the postero–lateral extremities.

Neotype locality

TM 56b, Winduck Group, Early Devonian (Lochkovian).

Other material

MMF 31333 anterior of cranidium: MMF 31334 posterior half of cranidium; MMF 31399 and 31400 poorly preserved cranidia; MMF 31377(10) and (11) hypostomes; MMF 31398 incomplete pygidium. The numbers in brackets refer to individual specimens on slabs with numerous fossils.

Other localities

TM 65, Winduck Group (MMF 31399 only).

Diagnosis

Craspedarges with 1L undivided between longitudinal furrows.

Description

The cranidium is very strongly convex, almost globose. The border is very distinct and anteriorly convex in section (sag.), being broadest near the anterior and posterior ends of the suture. The border furrow is narrow, except at the genal angles, and well defined. The rachial furrows are indistinct on the posterior border and effaced on the postero–lateral cranidial lobe between the palpebral lobe and posterior border furrow. The occipital ring is poorly defined laterally because of the weak posterior rachial furrows, but is clearly differentiated from 1L by the occipital furrow. The longitudinal furrows are weak between the posterior margin and S1 but deep anteriorly and sub–parallel along the inner sides of the bullar lobes. The median part of 1L is well marked by the longitudinal furrows and comparative depression among otherwise inflated lobes but the lateral ends are lost in the undifferentiated postero–lateral cranidial lobes. The bullar lobes are clearly defined by the circumscribing furrows. The median lobe is the most inflated part of the cranidium and very wide anteriorly, though the antero–lateral extremities do not overlap the bullar lobes. The surface is covered with small pointed tubercles that are finer on the border. [The perforations on some tubercles are believed to be bubbles in the latex cast and are irregular in distribution.] The free cheeks are unknown.

The hypostome is wider than long although the posterior border is incomplete on both specimens. The posterior lobe is narrow (sag.) and crescentic in shape compared with the larger subquadrate anterior lobe. The surface of at least the median body is

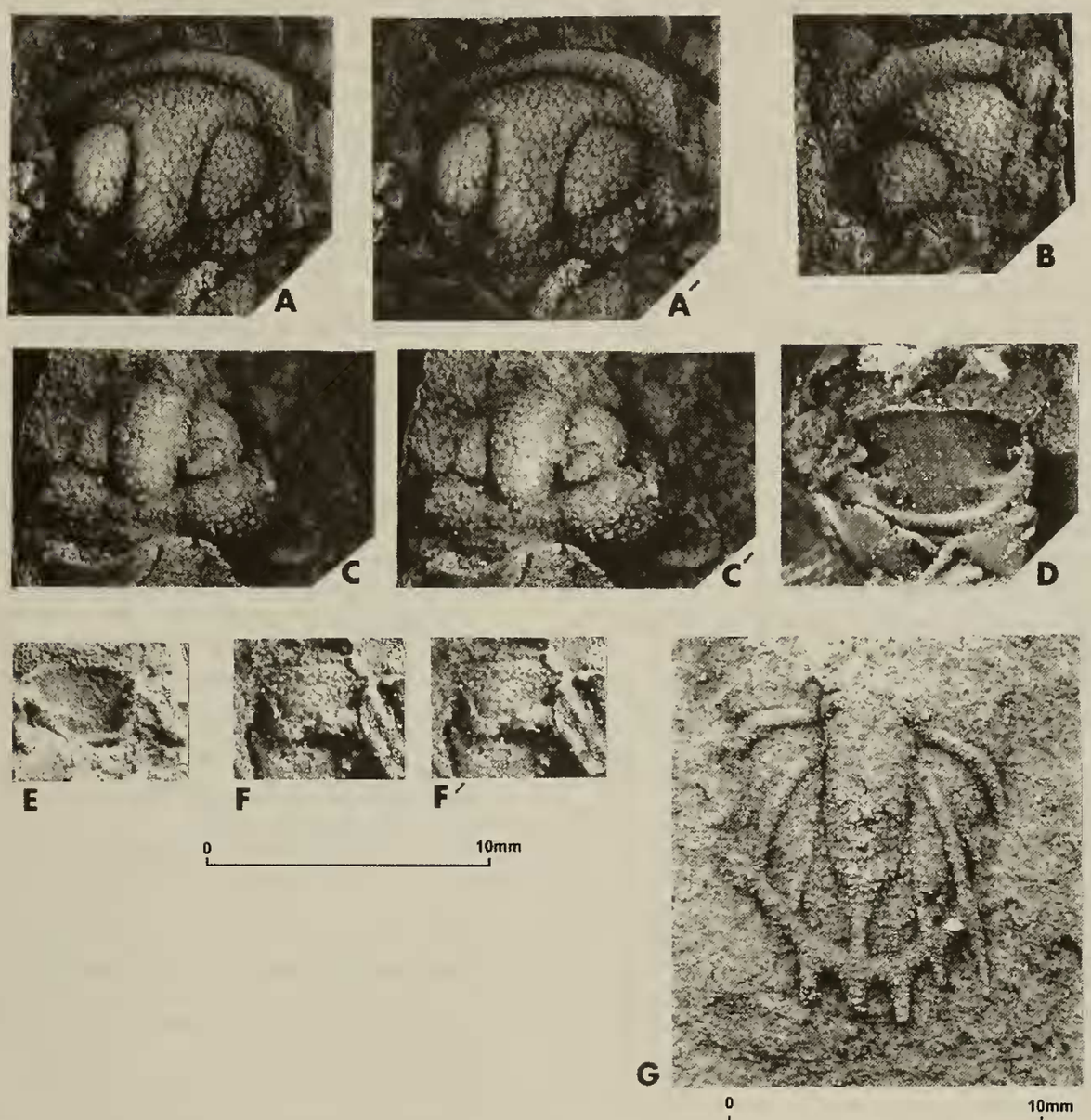

Figure 3. ***Craspedarges wilcanniae*** **Gürich; A, A' MMF 31377(5) neotype, stereo pair of latex cast of exterior of incomplete cranidium; B MMF 31399 latex cast of exterior of flattened incomplete cranidium showing impact on anterior border; C, C' MMF 31334 stereo pair of latex cast of exterior of posterior part of cranidium; D MMF 31377(11) latex cast of interior of hypostome; E–F MMF 31377(10) latex casts of interior and exterior of hypostome, E interior, F, F′ stereo pair of incomplete exterior; G MMF 31398 latex cast of incomplete pygidium.**

ornamented with tubercles finer but otherwise comparable with those on the cranidium.

No thoracic segments of this species are known.

The only pygidium is incomplete at its anterior edge and the rings are not preserved on the prominent rachis. The posterior edges of the three pleurae form well defined ribs in the pleural fields, the ribs on the second and third pleurae being continued beyond the well defined raised border as robust spines. The very poorly preserved internal mould, counterpart to the exterior in Figure 3G, shows that the first pleura is also continued beyond the border as a marginal spine of uncertain length. The internal mould also shows a short, comparatively broader spine corresponding to the anterior edge of the second pleura, making a total of five pairs of marginal spines. The pair flanking the terminal spine are in the position that would correspond to a fourth pair of pleurae. The surface is covered with irregularly distributed and

widely spaced granules. The doublure is unclear in extent but is approximately as wide as the border.

Dimensions

Because of the fragmentary preservation some of the dimensions have been extrapolated by doubling measurable half widths.

	length (mm)	width (mm)
MMF 31377(5) cranidium	9.0	9.5
MMF 31334 cranidium (posterior)		12.5
MMF 31398 pygidium (ex spines)	10.5	10.0

Remarks

The reasons for assuming that these specimens are truly conspecific with Gürich's originals are discussed under the generic remarks. The only other species assigned to this genus, *Craspedarges superbus* Kobayashi and Hamada (1977a) from Japan, was questionably assigned to *Richterarges* by Thomas and Holloway (1988), although this decision was influenced by the poorly known morphology of *Craspedarges wilcanniae*. The extra pair of pleural segments and five pairs of marginal spines on the pygidium described by Kobayashi and Hamada (1977a) is in agreement with *Craspedarges wilcanniae*, the main distinction being that S1 in *Craspedarges superbus* is not discrete but instead merges medially with the occipital furrow. The age of *Craspedarges superbus* is imprecise, Kobayashi and Hamada (1977b) giving an age range from Gedinnian to early Eifelian. The earlier limit accords with the age of *Craspedarges wilcanniae* and the Winduck Group.

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APPENDIX
FOSSIL LOCALITIES

Grid references (GR) are from 'The Meadows' 1:100 000 topographic map. Other localities were sampled using the Barnato 1:250 000 grid; the original grid reference, shown in brackets, has been retained. Unless otherwise stated the fossils are in sandstone beds protruding above the surrounding scree of finer, more thinly bedded sediments or soil. All localities are within the Cobar Supergroup but in this region it has not been possible to subdivide the Amphitheatre and Winduck Groups.

NB 1 GR 559 123 (Barnato 1:250 000 GR 34601015): unnamed off white fine grained quartzose sandstone member, Amphitheatre Group.

TM 56b GR 459 008: fine grained micaceous quartz sandstone, Winduck Group.

TM 65 GR 4630 0095: fine grained orthoquartzite, Winduck Group.

TM 312 GR 505 130: pale reddish purple massive or thickly bedded siltstone exposed in gravel scrapes, Amphitheatre Group.